

CLAIMS

1-2. (Cancelled)

3. (Previously Presented) A method of visual communication between a signal transmitting device and a signal receiving device comprising:

adjusting a display unit of said signal transmitting device and a visual recording device of said signal receiving device and using an alternating display process to establish a visual connection between said display unit and said visual recording device;

encoding a signal pattern as a visual image pattern using a generated signal template of said signal transmitting device;

visually transmitting the visual image pattern through free space from the display unit of said signal transmitting device;

receiving the visual image pattern using the visual recording device of said signal receiving device; and

decoding the signal pattern from the visual image pattern using an image decoder of the signal receiving device,

wherein adjusting the visual recording device includes the steps of:

automatically adjusting pan and tilt of the visual recording device to have a view of the visual image pattern displayed by the display unit; and

automatically adjusting an angle size of the visual recording device,

and wherein automatically adjusting the pan and tilt for the visual recording device comprises:

selecting a first tilt and a first pan position;

panning for a position that does not overlap said first pan position;
checking if panning positions have been exhausted;
determining whether the first tilt is in a horizontal position if all panning positions have been exhausted; and
determining a new tilt by moving the first tilt upwards for the value of $h/2$ if the first tilt is in a horizontal position.

4. (Previously Presented) The method of claim 3, wherein the decoding comprises:

dividing the visual image pattern into a plurality of blocks;
determining the centers of said blocks using a position and radius look-up table;
creating a plurality of circles within said blocks having corresponding centers and radiuses determined by the position and radius look-up table;
calculating average image intensities within said circles;
using average image intensities within said circles as average image intensities of respective blocks of each of said circles;
determining a plurality of black and white intensities from said average intensities of respective blocks of each of said circles using predetermined values; and
decoding a pattern created by said black and white intensities.

5. (Previously Presented) The method of claim 3, wherein the alternating display process comprises:

alternating an image on the display unit of a sending device within an allotted time;

collecting a plurality of alternating images by said visual recording device of the visual receiving device within an allotted time;

calculating image differences of consecutive alternating images;

changing said image differences into black and white images based on pixel values; and

collecting a plurality of blobs for each of said image differences using the visual recording device, wherein the blob having a largest area value represents the display unit.

6. (Cancelled)

7. (Original) The method of claim 4, wherein the radiuses of said circles are 35% of the length of their respective blocks.

8. (Original) The method of claim 5, wherein the blobs are groups of adjoining pixels each having an identical pixel value.

9. (Cancelled)

10. (Previously Presented) The method of claim 3, wherein if all panning positions have not been exhausted, further comprising panning for a position that does not overlap a previous pan position.

11. (Previously Presented) The method of claim 3, wherein if the first tilt is above the horizontal position, the new tilt will be below the horizontal position and symmetric to the first tilt.

12. (Previously Presented) The method of claim 3, wherein if the first tilt is below the horizontal position, further comprising:

determining that the first tilt is not above the horizontal position;

finding a previous tilt that is symmetric to the first tilt and is above the horizontal position;

creating a possible tilt by moving the first tilt upwards for $h/2$ with respect to said previous tilt; and

determining if said possible tilt passes a vertical direction with respect to the horizontal position.

13. (Original) The method of claim 12, wherein if said possible tilt passes the vertical position, then all tilts are exhausted.

14. (Original) The method of claim 12, wherein if said possible tilt does not pass the vertical position, then said possible tilt is a next tilt.

15. (Previously Presented) A program storage device readable by machine, tangibly embodying a program of instructions executable by machine to perform method steps for communication between processing devices comprising the steps of:

generating a visual image pattern using a generated signal template;

displaying the visual image pattern on a display unit;

adjusting a visual recording device and said display unit and using an alternating display process to establish a visual connection between the processing devices;

acquiring, visually, an image of the visual image pattern displayed by the display unit using the visual recording device; and

decoding the visual image pattern with an image decoder,

wherein the instructions for adjusting the visual recording device and said display unit includes instructions for:

automatically adjusting the pan and tilt of the visual recording device to have a view of the visual image pattern displayed by the display unit; and

automatically adjusting the angle size of the recording device,

and wherein the instructions for performing the step of automatically adjusting the pan and tilt for a visual recording device includes instructions for performing the steps of:

selecting a first tilt and a first pan position;

panning for a position that does not overlap said first pan position;

checking if panning positions have been exhausted;

determining whether the first tilt is in a horizontal position if all panning positions have been exhausted; and

determining a new tilt by moving the first tilt upwards for the value of $h/2$ if the first tilt is in a horizontal position.

16. (Previously Presented) The program storage device of claim 15, wherein the instructions for decoding includes instructions for:

dividing the image of the visual image pattern into a plurality of blocks;

determining the centers of said blocks using a position and radius look-up table;
creating a plurality of circles within said blocks having corresponding centers and radiuses determined by the position and radius look-up table;
calculating average image intensities within said circles;
using average image intensities within said circles as average image intensities of respective blocks of said circles;
determining a plurality of black and white intensities from said average intensities of respective blocks of said circles using predetermined values; and
decoding a pattern created by said black and white intensities.

17. (Previously Presented) The program storage device of claim 15, wherein the alternating display process comprises:

alternating an image on the display unit of a sending device within an allotted time;
collecting a plurality of alternating images by a visual recording device of a receiving device within an allotted time;
calculating image differences of consecutive alternating images;
changing said image differences into black and white images based on pixel values; and
collecting a plurality of blobs for each of said image differences with the visual recording device, wherein the blob having a largest area value represents the signal display.

18. (Cancelled)

19. (Original) The program storage device of claim 16, wherein the radiuses of said circles are 35% of the length of their respective blocks.
20. (Original) The program storage device of claim 17, wherein the blobs are groups of adjoining pixels each having an identical pixel value.
21. (Cancelled)
22. (Previously Presented) The program storage device of claim 15, wherein if all panning positions have not been exhausted, the instructions for performing the step of panning for a position that does not overlap the first pan position are repeated.
23. (Previously Presented) The program storage device of claim 15, wherein if the first tilt is above the horizontal position, the new tilt will be below the horizontal position and symmetric to the first tilt.
24. (Previously Presented) The program storage device of claim 15, wherein if the first tilt is below the horizontal position, including instructions for performing the steps of:
- determining that the first tilt is not above the horizontal position;
 - finding a previous tilt that is symmetric to the first tilt and is above the horizontal position;
 - creating a possible tilt by moving the first tilt upwards for $h/2$ with respect to said previous tilt;

determining if said possible tilt passes a vertical direction with respect to the horizontal position.

25. (Original) The program storage device of claim 24, wherein if said possible tilt passes the vertical position, then all tilts are exhausted.

26. (Original) The program storage device of claim 24, wherein if said possible tilt does not pass the vertical position, then said possible tilt is a next tilt.

27-30. (Cancelled)

31. (Previously Presented) A method of visual communication between a signal transmitting device and a signal receiving device comprising:

- adjusting a display unit of said signal transmitting device and a visual recording device of said signal receiving device and using an alternating display process to establish a visual connection between said display unit and said visual recording device;

- encoding a signal pattern as a visual image pattern using a generated signal template of said signal transmitting device;

- visually transmitting the visual image pattern through free space from the display unit of said signal transmitting device;

- receiving the visual image pattern using the visual recording device of said signal receiving device; and

decoding the signal pattern from the visual image pattern using an image decoder of the signal receiving device,

wherein the decoding comprises:

dividing the visual image pattern into a plurality of blocks;

determining the centers of said blocks using a position and radius look-up table;

creating a plurality of circles within said blocks having corresponding centers and radiuses determined by the position and radius look-up table;

calculating average image intensities within said circles;

using average image intensities within said circles as average image intensities of respective blocks of each of said circles;

determining a plurality of black and white intensities from said average intensities of respective blocks of each of said circles using predetermined values; and

decoding a pattern created by said black and white intensities,

wherein the radiuses of said circles are 35% of the length of their respective blocks.

32. (Previously Presented) A program storage device readable by machine, tangibly embodying a program of instructions executable by machine to perform method steps for communication between processing devices comprising the steps of:

generating a visual image pattern using a generated signal template;

displaying the visual image pattern on a display unit;

adjusting a visual recording device and said display unit and using an alternating display process to establish a visual connection between the processing devices;

acquiring, visually, an image of the visual image pattern displayed by the display unit using the visual recording device; and

decoding the visual image pattern with an image decoder,

wherein the instructions for decoding includes instructions for:

dividing the image of the visual image pattern into a plurality of blocks;

determining the centers of said blocks using a position and radius look-up table;

creating a plurality of circles within said blocks having corresponding centers and radiuses determined by the position and radius look-up table;

calculating average image intensities within said circles;

using average image intensities within said circles as average image intensities of respective blocks of said circles;

determining a plurality of black and white intensities from said average intensities of respective blocks of said circles using predetermined values; and

decoding a pattern created by said black and white intensities,

wherein the radiuses of said circles are 35% of the length of their respective blocks.